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ABSTRACT

This paper reports a study involving the construction and validation of a learning environment questionnaire that was used by both kindergarten students and their parents. Although the questionnaires were validated for use with five- and six-year old kindergarten students, the same format was used for both parents and students. Prior learning environment studies (Fraser, 1998a) had not necessarily been designed or used by parents (with a notable exception being the recent study by Allen and Fraser, 2002) or by such young students. This study is significant because it involved very young students (kindergarten), the assessment of parents' and students' preferred and actual learning environments, and investigation of differences between students' and parents' environment perceptions. First, an existing valid questionnaire (Fraser, McRobbie and Fisher, 1996) was modified in English and Spanish for very young children (five- and six-years old) and for their parents to assess kindergarten students' and their parents' actual and preferred learning environment. The 'new' questionnaire was checked for validity and reliability. Secondly, differences between kindergarten students and their parents in actual and preferred learning environments in a science classroom were explored. Finally, associations between kindergarten students' achievement and attitudes and students' and parent' perceptions of the learning environment in a science classroom were investigated. (Contains 26 references.) (Author)

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KINDERGARTEN STUDENTS' AND THEIR PARENTS' PERCEPTIONS OF SCIENCE ENVIRONMENTS: ACHIEVEMENT AND ATTITUDES

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This paper reports a study involving the construction and validation of a learning environment questionnaire that was used by both kindergarten students and their parents. Although the questionnaires were validated for use with five- and six-year old kindergarten students, the same format was used for both parents and students. Prior learning environment studies (Fraser, 1998a) had not necessarily been designed or used by parents (with a notable exception being the recent study by Allen & Fraser, 2002) or by such young students. This study is significant because it involved very young students (kindergarten), the assessment of parents' and students' preferred and actual learning environments, and investigation of differences between students' and parents' environment perceptions. First, an existing valid questionnaire (Fraser, McRobbie & Fisher, 1996) was modified in English and Spanish for very young children (five- and six-years old) and for their parents to assess kindergarten students' and their parents' actual and preferred learning environment. The 'new' questionnaire was checked for validity and reliability. Secondly, differences between kindergarten students and their parents in actual and preferred learning environments in a science classroom were explored. Finally, associations between kindergarten students' achievement and attitudes and students' and parents' perceptions of the learning environment in a science classroom were investigated.

BACKGROUND

The extent to which teaching and learning are productive depends partly on the participants' environment, which is a set of dispositions that incline individuals to act and interact in particular ways (Bourdieu 1992; Lemke, 1985). The study of learning environments built on Lewin's (1936) theory dealing with the relationship and interaction between the individual and his/her environment. Lewin (1936) and Murray (1938) were most likely the first individuals to recognize relationships between the environment and human behavior, thus laying the foundation for the development of the first learning environment scales.

In the past three decades, much attention has been given to the development and use of instruments to assess the qualities of the classroom learning environment from the perspective of the student (Fraser, 1994, 1998a, 1998b, 2002; Fraser & Walberg, 1991). The relationship between learning environment variables and student outcomes has provided a specific focus for the application of learning environment instruments.

Fraser, Fisher, and McRobbie (1996) felt that there was a need for a single instrument that would combine some of the best features from previously-developed instruments to better understand the socio-psychological climate of classrooms. Therefore they developed the What Is Happening In this Class? (WIHIC) questionnaire, which formed the starting point for this study.

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This study adds to the field of learning environments because it modified and validated questionnaires to assess kindergarten students' and their parents' perceptions of the actual and preferred learning environment, investigated differences between parents' and students' perceptions of the actual and preferred learning environments, and explored associations between the environment and students' achievement and attitudes in science classrooms.

School, work, and family settings can be described in terms of a set of conceptually-related dimensions that appear to have common influences (Fraser & Walberg, 1991). When schools are more involved with their communities and when teachers and parents see and talk more often with one another, they are more likely to know about one another's needs and are better able to work in tandem to promote the learning and welfare of students. This implies that the development and achievement outcomes of education can often be improved if schools become more involved in the lives of their local communities (Berliner & Biddle, 1995).

Parent programs have been found to have significant and positive effects on children's verbal ability, language, school-related knowledge and skills, and achievement in school subjects, especially when integrated into a network of community support (Kellaghan, Sloane, Alvarez, & Bloom, 1993). Other research has revealed that toddlers' vocabulary development is related to the amount of parental speech (Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991) and parental efforts to describe environmental stimuli that capture a toddler's attention.

AIMS

1. To develop valid and reliable questionnaires in English and Spanish to assess:

    a. kindergarten students' actual and preferred learning environment.
    b. their parents' actual and preferred learning environment.

2. To investigate differences between kindergarten students and their parents in their perceptions of:

    a. actual learning environment in a science classroom.
    b. preferred learning environment in a science classroom.

3. To investigate associations between kindergarten students' achievement and attitudes and:

    a. students' perceptions of the learning environment in a science classroom.
    b. their parents' perceptions of the learning environment in a science classroom.

METHODS

Learning Environment Questionnaire

Fraser, Fisher, and McRobbie (1996) developed a learning instrument called the *What Is Happening In this Class?* (WIHIC) questionnaire. Past studies have revealed that the WIHIC is a

valid reliable instrument for measuring actual and preferred learning environments in studies in Australia and Taiwan (Aldridge & Fraser, 2000), the USA (Allen & Fraser, 2002), Canada (Raaflaub & Fraser, 2003), Singapore (Fraser & Chionh, 2000) and Indonesia (Magianti, Fraser, & Aldridge, 2001). The original version of the WIHIC was modified and translated into Spanish using the procedures of translation and back translation recommended by Brislin (1970) and described by Aldridge and Fraser (2000) in their cross-national study of classroom environments in Taiwan and Australia. The WIHIC was deemed to be a highly suitable instrument for assessing the learning environment at the kindergarten level, and for evaluating both students' and parents' perceptions of the learning environment.

The WIHIC was modified from 56 items in seven scales to 20 items in five scales, in order to facilitate understanding and to reduce administration time among five-and six-years old students who participated in the study, along with members of a self-contained English Speakers of Other Languages (ESOL) class and parents. The modified version of the WIHIC questionnaire used by kindergarten students and their parents had four forms. Two forms were used to measure the students' and parents' perception of actual classroom environment, while the other two were used to measure students' and parents' preferred classroom environment. Table 1 provides descriptive information about the version of the WIHIC used in our study.

Combining Qualitative and Quantitative Methods

Tobin and Fraser (1998) advocate that research on learning environments can be enhanced by using multiple theoretical frames to illuminate the experiences of key participants in the learning of science and by using a variety of research methods that can lead to a rich yield of qualitative and quantitative data. They went on to add that the benefit of using multiple approaches is that complementary insights can lead to the identification of new problems and possible solutions to new and persistent problems. They were unable to envision why learning environment researchers would opt for either qualitative or quantitative data, when clearly the use of both can be used to obtain more credible and authentic outcomes.

Qualitatively, our study incorporated the use of interviews and observations, in the hope of obtaining a richer representation of the learning environment. The What is Happening In this Class? (WIHIC) questionnaire (Fraser, Fisher, & McRobbie, 1996) partly formed a foundation for the interview questions. Students in the classrooms and parents were interviewed and surveyed to provide support and clarifications for the quantitative data-collection segments of the study that were used to assess perceptions of the learning environment. Quantitatively this study was able to investigate relationships between variables using modified versions of the WIHIC questionnaire and the Test of Science-Related Attitudes (TOSRA) and to answer the research questions of this study involving: assessment of classroom environments; differences between students' and parents' perceptions of the actual and preferred learning environment; and associations between achievement and attitudes. The qualitative findings were merged with the quantitative findings.

Table 1. Scale Descriptions and Sample Items for the Modified Version of the Actual and Preferred WIHIC for Students and Parents

Scale	Description	Sample Actual Item		Sample Preferred Item	
		Student	Parent	Student	Parent
Student Cohesiveness	Extent to which students know, help and are friendly towards each other	I am nice to kids in this class.	My child is nice to other kids in this class.	I would be nice to kids in this class.	My child would be nice to other kids in this class.
Teacher Support	Extent to which teacher is interested in the students, while displaying characteristics of helpfulness, trustfulness, friendliness, etc.	The teacher's questions help me understand.	The teacher's questions help my child understand.	The teacher's questions would help me understand.	The teacher's questions would help my child understand.
Involvement	Extent to which students' involvement reflects enjoyment.	My ideas are used during science class.	My child's ideas are used during science class.	My ideas would be used during science class.	My child's ideas would be used during science class.
Cooperation	Extent to which students collaborate and support each other.	Other kids and I work together like a team.	Other kids and my child work together like a team.	Other kids and I would work together like a team.	Other kids and my child would work together like a team.
Equity	Extent to which students are treated equally.	I am treated the same way as other students in my science class.	My child is treated the same way as other students in this class.	I would be treated the same way as other students in my science class.	My child would be treated the same way as other students in this class.

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Student Outcome Measures

The student outcomes in this study included students' attitudes towards science and their achievement. The Test of Science-Related Attitudes (TOSRA; Fraser, 1981) was used to measure attitudes toward science. The TOSRA was originally designed to measure seven distinct science-related attitudes among secondary school students, to be suitable for group administration, and to be administered within the duration of a normal class lesson. Furthermore TOSRA has been carefully developed and extensively field tested and has been shown to be highly reliable (Fraser, 1981). A major advantage that TOSRA has over some other science attitude questionnaires is that it yields a separate score for a number of distinct attitudinal aims instead of a single overall score. This makes it possible to obtain a 'profile' of attitude scores for groups of students (Fraser, 1981).

A modified version of (TOSRA) was used for this study for the purpose of exploring associations between students' attitudes to science and their perceptions of the learning environment. Due to the young age of the students (five-to six-years old), the number of items was reduced from 70 to 24. Out of the seven original scales, only three were chosen for our study (Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, and Enjoyment of Science Lessons) as the most appropriate for our study. Attitude to Scientific Inquiry measures attitude to scientific experimentation and questioning as a way to obtain information about our natural world. Adoption of Scientific Attitudes measures 'scientific attitudes' like eagerness to modify/change opinions after acquiring new information. Enjoyment of Science measures contentment with science learning experiences at school or in the classroom. Students respond on a five-point scale consisting of Strongly agree, Agree, Not sure, Disagree, and Strongly disagree.

Student's Final Report (final grades in science) along with the Kindergarten Diagnostic Test and Kindergarten Readiness Test (both of these tests were given at the beginning and end of the year) were used as measures of student achievement.

Sample

The student sample consisted of 172 kindergarteners ranging from five-to six-years of age. These 172 students derived from six kindergarten classes of one elementary school located in a large urban district in South Florida. The ethnic make-up for this group of 172 students was 11.8% White, 49.0% Black, 33.6% Hispanic, and 5.6% of other nationalities. The gender breakdown was 40.4% boys and 59.6% girls. Approximately 45% of the kindergarten student population was made up of English for Speakers of Other Languages (ESOL). The 172 students comprised the populations whose parents had granted authorization for students to respond the questionnaires. The WIHIC and TOSRA were administered to all of these 172 students.

Out of the total student sample of 172 students, only 78 parents of the same students from the above six classes agreed to participate in the study, and 28 parents granted permission for us to access their child's achievement records for the purpose of this study. This subsample of 28 students consisted of the students who one of the researchers, Robinson, had in her class at the end of the school year.

From this population of 78 parents, 10 parents agreed to be included in follow-up interviews. As well, 10 students of these parents were interviewed.

Interviews

Because we cannot observe how people have organized the world and the meanings which they attach to what goes on in the world, we have to ask people questions about those things. The purpose of interviewing, then, is to allow us to enter the other person's perspective (Patton, 1987). The style of 'key informant' interviews focuses on the views of a small number of individuals. For this reason, key informant interviews seemed the most appropriate type of interviews for this study. Determining feelings and perceptions of the students and parents without necessarily having them arrive at any consensus seemed like an interesting search. Four sets of interviews were conducted. The first two interviews involved students. One student interview was conducted in Spanish and the second interview was conducted in English. The second set of interviews involved parents. One parent interview was conducted in Spanish and the second interview was conducted in English. The parents who participated in the interviews were the parents of the students who participated in the student interviews. All interviews were conducted at different times and dates.

RESULTS

In order to check the validity and reliability of the What is Happening In this Class (WIHIC) questionnaire, the following statistical measures were determined: factor structure, internal consistency (alpha reliability), discriminant validity, and the ability to differentiate between classes (by using ANOVA). In order to check the validity and reliability of TOSRA, the Cronbach alpha coefficient was calculated to establish the internal consistency reliability of the scales, and the discriminant validity was checked using the correlations between scales.

Factor Loadings for WIHIC

To investigate the factor structure of the modified version of the WIHIC when used with kindergarten students, factor analysis with varimax rotation was conducted. Information about the factorial validity of the students' actual form is shown in Table 2 for the sample entailed 172 students. Of the sample of 172 kindergarten students, 156 answered the questionnaire in English and 16 answered the questionnaire in Spanish. The number of students answering in Spanish (a limitation of our study) was too small to permit meaningful validation of the Spanish version. Thus, the responses of students answering in Spanish were combined with the 156 responses in English for analysis purposes.

Faulty WIHIC items were identified using both factor and item analyses. Exclusion of those faulty questionnaire items enhanced the internal consistency reliability and factorial validity. Sixteen (16) of the original modified 20 items were kept in the original four-factor structure of Teacher Support, Involvement, Cooperation, and Equity as shown in Table 2. Table 2 provides the factor loading for each of the retained 16 items. Only factor loadings of at least 0.40 have been included. For 15 of the 16 retained items in Table 2, the loading is greater than 0.40 on the a-priori scale and less than 0.40 on the other three scales. Item 8 ("The teachers' questions help

me understand") loaded on both Teacher Support and Equity. Items 1, 2, 3, and 4 loaded smaller that 0.40 on their a-priori scale and therefore were omitted. Although Item 5's loading was less than 0.40 on its own scale (Teacher Support), it still was retained in the instrument.

Table 2. Factor Loadings for the Modified WIHIC (Student Actual Version)

Item No	Factor Loading			
	Teacher Support	Involvement	Cooperation	Equity
5	-			
6	0.55			
7	0.67			
8	0.54			0.47
9		0.65		
10		0.41		
11		0.58		
12		0.52		
13			0.68	
14			0.70	
15			0.50	
16			0.41	
17				0.58
18				0.64
19				0.71
20				0.65
Eigenvalue	1.14	1.20	1.33	5.69
% Variance	8.95	10.40	11.34	14.82

Factor loadings smaller than 0.40 have been omitted. The sample consisted of 172 students.

Internal Consistency, Discriminant Validity, and Ability to Differentiate Between Classrooms for WIHIC

The internal consistency reliability of WIHIC scales was checked using Cronbach's alpha coefficient. The discriminant validity, or scale independence, was checked by using the mean correlation of a scale with other scales. Internal consistency and discriminant validity were calculated separately for actual and preferred forms of the WIHIC and for the student sample (n = 172) and the parent sample (n = 78). Also the ability of the actual version of each WIHIC scale to differentiate between the perceptions of students in different classes was checked, using ANOVA with class membership as the main effect. These results are found in Table 3.

The internal consistency (alpha reliability) for different WIHIC scales for students ranges from 0.67 to 0.81 for the actual science learning environment, and from 0.64 to 0.77 for the preferred science learning environment. The alpha reliability for parents ranges from 0.89 to 0.95 for the actual science learning environment, and from 0.64 to 0.86 for the preferred science learning environment (Table 3).

The discriminant validity (mean correlation with other scales) indicates whether each scale is distinct in what it measures. The mean correlation with other scales for students ranges from 0.45

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to 0.51 for the actual science learning environment, and from 0.56 to 0.60 for the preferred science learning environment. The mean correlation with other scales for parents for the actual science learning environment ranges from 0.68 to 0.73, and from 0.31 to 0.47 for the preferred science learning environment (Table 3). Overall, many of the discriminant validity values are quite high for actual and preferred forms and for students and parents. This suggests that raw scores on the WIHIC assess overlapping dimensions, although the factor analysis results (Table 2) attest to the independence of factor scores on the WIHIC's student actual version.

The final column in Table 3 reports the results of the ANOVA (ability to differentiate between classes) for the actual form of each WIHIC scale for the student sample. These results attest to whether each scale can differentiate between the perceptions of students in different classes. Table 3 reports the amount of variance accounted for by class membership (eta^2 statistic) and whether results are statistically significant. The eta^2 statistic ranges from 0.16 to 0.20, and it is statistically significant for each of the four WIHIC scales.

Table 3. Internal Consistency Reliability (Cronbach Alpha Coefficient), Discriminant Validity (Mean Correlation With Other Scales) and Ability to Differentiate Between Classes (ANOVA) Results for Actual and Preferred Forms of WIHIC for Students and Parents

Scale	No. of Items	Unit of Analysis	Alpha Reliability		Mean Correlation with other Scales		ANOVA Eta^2
			Students	Parents	Students	Parents	Students
Teacher Support	4	Actual	0.67	0.89	0.48	0.70	0.20**
		Preferred	0.73	0.64	0.60	0.44	
Involvement	4	Actual	0.69	0.90	0.45	0.68	0.17**
		Preferred	0.75	0.86	0.59	0.47	
Cooperation	4	Actual	0.77	0.89	0.50	0.73	0.16**
		Preferred	0.77	0.70	0.62	0.44	
Equity	4	Actual	0.81	0.95	0.51	0.71	0.30**
		Preferred	0.64	0.76	0.56	0.31	

** $p < 0.01$.
The sample consisted of 172 students in 6 classes and 78 parents.

Internal Consistency Reliability and Discriminant Validity for the Modified TOSRA

For each of the three modified TOSRA scales used in our study, internal consistency reliability was determined using Cronbach's alpha coefficient and the discriminant validity was calculated using the correlation between scales. The findings are reported in Table 4 for the student sample of 172 students.

The alpha reliability coefficient for *Enjoyment of Science Lessons* was 0.96, for *Adoption of Science Attitudes* was 0.56, and for *Attitudes to Scientific Inquiry* was 0.80. The magnitude of the correlation between pairs of scales ranges from 0.03 to 0.33, suggesting reasonable scale independence.

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Table 4. Internal Consistency Reliability (Cronbach Alpha Coefficient) and Discriminant Validity (Correlation With Other Scales) for the Modified TOSRA

Scale	No. of Items	Alpha Reliability	Correlation with other Scales	
			Enjoyment of Science Lessons	Adoption of Science Attitudes
Enjoyment of Science Lessons	4	0.96	-	-
Adoption of Science Attitudes	4	0.56	0.04	-
Attitude to Scientific Inquiry	4	0.80	-0.03	-0.33

The sample consisted of 172 students in 6 classes.

Differences Between Actual and Preferred Learning Environment for Either Students or Parents

To examine any differences between actual and preferred learning environment for either students or parents, means, standard deviations, effect sizes, and *t* tests for paired samples were produced.

Table 5 compares the average item mean (i.e. the scale mean divided by the number of items in that scale) of each WIHIC scale for the actual and preferred forms. Data are provided separately for students and parents. The average item mean was used to enable easy comparison of the average scores on different scale items.

The differences between actual and preferred scores on each scale were investigated using effect sizes and *t* tests for paired sample. The effect size, or the difference between means expressed in standard deviation units (Brislin, 1970), provides an index of the magnitude of an effect (see Table 5) and therefore its educational importance. On the other hand, the *t* test results provide information about the statistical significance of differences.

Table 5 shows that students' scores are significantly higher on each scale for the preferred version than for the actual version. The effect sizes for students range from 1.58 to 2.48 standard deviations, suggesting large actual-preferred differences. For parents, Table 5 shows that actual-preferred differences are statistically significant for all WIHIC scales, and that effect sizes range from 0.56 to 0.96.

Although actual-preferred differences are statistically significant in Table 4 for all WIHIC scales for both students and parents, the magnitudes of the differences clearly are bigger for students than for parents. For example, effect sizes for actual-preferred differences range from 0.56 to 0.96 for parents, but they have the much larger range from 1.58 to 2.48 standard deviations for students.

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Table 5. Average Item Mean, Average Item Standard Deviation, Difference Between Actual and Preferred Scores (Effect Size and *t* Tests for Paired Sample) for Students or Parents on Modified WIHIC

Scale	Parents/ Students	Average Item Mean		Average Item Standard Deviation		Difference	
		Actual	Preferred	Actual	Preferred	Effect Size	*t*
Teacher Support	Students	1.67	2.80	0.61	0.44	1.58	17.95**
	Parents	2.25	2.83	0.82	0.39	0.96	6.22**
Involvement	Students	1.51	2.77	0.54	0.48	2.47	21.48**
	Parents	1.78	2.24	0.82	0.81	0.56	4.14**
Cooperation	Students	1.55	2.82	0.64	0.43	2.37	21.66**
	Parents	1.81	2.42	0.81	0.64	0.84	5.94**
Equity	Students	1.57	2.86	0.69	0.35	2.48	21.10**
	Parents	2.11	2.74	0.92	0.49	0.89	5.68**

**$p < 0.01$.
N = 172 students and 78 parents.

Figure 1 graphically illustrates the average item means. Overall both students and parents perceive a less favorable actual science classroom environment than what they would prefer. This is consistent with previous studies conducted by Fraser (1998a) and Henderson, Fisher and Fraser (2000) showing that students prefer a classroom environment that is more favorable than the one which they perceive as actually being present.

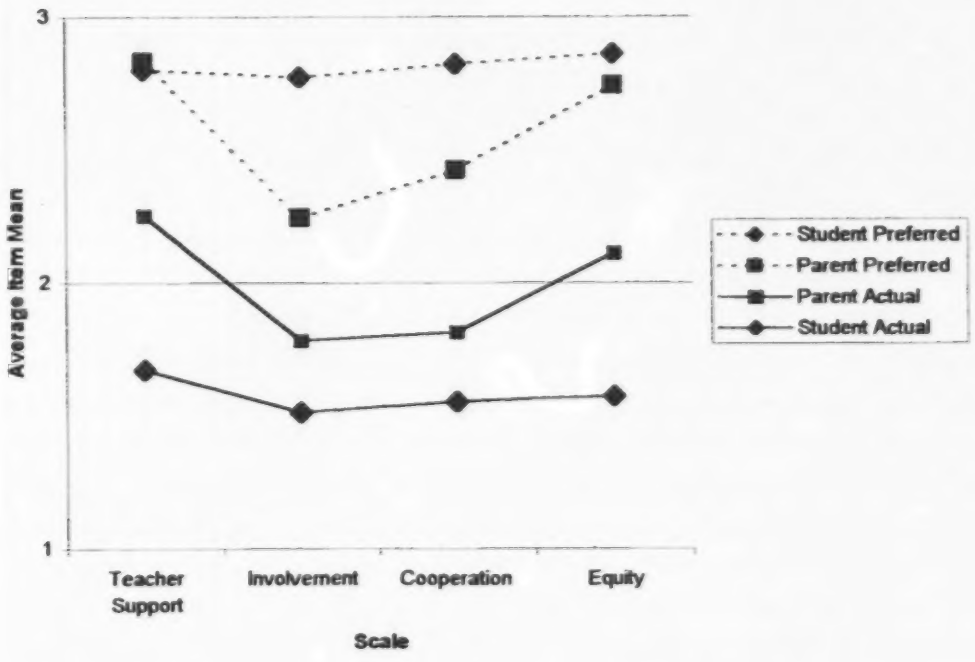

Figure 1: Students' and Parents' Average Item Mean on the Actual and Preferred Versions of the WIHIC.

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Differences Between Students and Parents in their Perceptions of Either Actual or Preferred Learning Environment

Table 6 compares students and parents in terms of the average item mean of each WIHIC scale for both actual and preferred forms. The differences between students' and parents' scores on each scale were investigated using effect sizes and *t*-tests for 78 matched pairs of students and parents.

Table 6 shows that students' and parents' scores are significantly different on every scale, except actual Cooperation. The effect size, which indicates the magnitude of differences, for different scales range from 0.29 to 0.74 standard deviations for the actual form and from 0.83 to 1.63 standard deviations for the preferred form. These effect sizes indicate a large difference between students' and their parents' perceptions of both actual and preferred learning environments.

Parents perceived the actual environment appreciably more favorably than students, while students prefer a more favorable environment than parents. This striking finding agrees with patterns revealed in the interview and focus groups, when parents indicated satisfaction with their child's current science classroom.

Table 6. Average Item Mean, Average Item Standard Deviation, and Differences Between Student and Parent Scores (Effect Size and *t* Test for Paired Samples) on the Actual and Preferred Forms of the Modified WIHIC

Scale	Form	Average Item Mean		Standard Average Item Deviation		Difference	
		Student	Parent	Student	Parent	Effect Size	*t*
Teacher Support	Actual	1.72	2.25	0.62	0.82	0.74	5.12**
	Preferred	2.80	2.23	0.44	0.39	0.83	-4.59**
Involvement	Actual	1.54	1.78	0.55	0.82	0.35	2.06*
	Preferred	2.76	2.23	0.48	0.81	1.47	-8.63**
Cooperation	Actual	1.60	1.81	0.65	0.81	0.29	1.80
	Preferred	2.82	2.43	0.43	0.63	1.63	-9.53**
Equity	Actual	1.61	2.11	0.70	0.92	0.62	3.95**
	Preferred	2.87	2.73	0.31	0.51	1.22	-6.43**

** $p < 0.01$.
$N = 78$ matched pairs of students and parents.

Figure 2 graphically illustrates differences between students and parents in terms of average item means on the WIHIC. Overall, both students and parents prefer a more favorable environment. However, parents perceive a more favorable environment than students, while students prefer a more favorable environment than parents.

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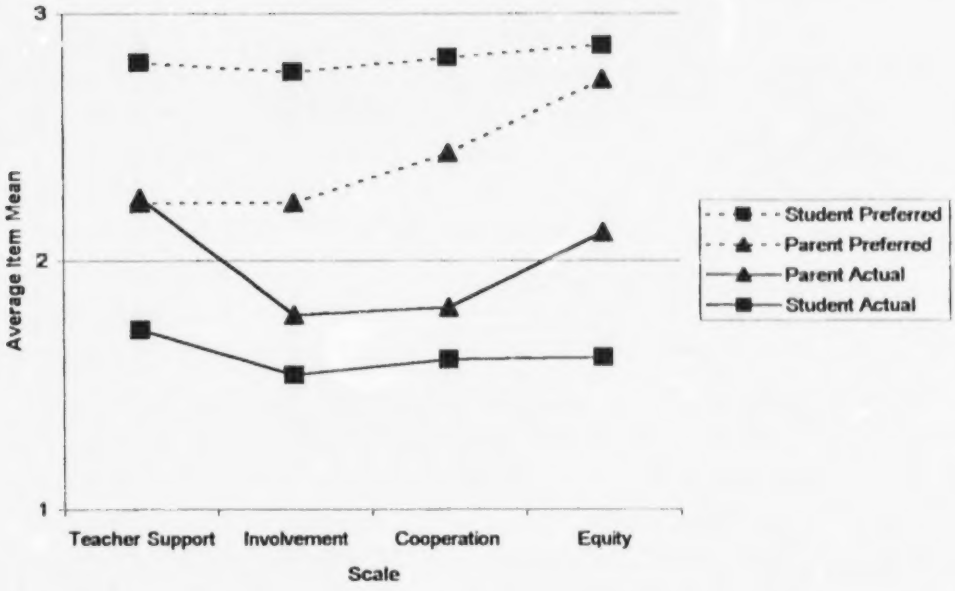

Figure 2: Students' and Parents' Scores on the Actual and Preferred Version of the WIHIC (N = 78).

Associations Between Student Outcomes and Dimensions of the Modified WIHIC

Following considerable prior research (Fraser, 1998a), we investigated associations between students' outcomes and their perceptions of the classroom learning environment. The outcome measures included three attitude scales adapted from the Test of Science-Related Attitudes (TOSRA; Fraser, 1981) and three measures of achievement in science. Whereas a sample of 172 was available for the attitude scales, only one class (n = 28) provided achievement data.

Simple correlation and multiple regression analyses were calculated to determine associations between students' attitudes and dimensions of the WIHIC. Whereas the simple correlation analysis provides information about bivariate associations between an outcome and an individual environment dimension, the multiple regression analysis provides a more parsimonious picture of the joint influence of a set of correlated environment scales on an outcome. Table 7 shows the relationships between each of three student attitude scales and the four scales of the modified WIHIC. The results of the simple correlation analysis in Table 7 show that 3 of the 12 simple correlations are statistically significant. *Adoption of Science Attitudes* is significantly and positively related to the environment scale *Equity*. *Attitudes to Scientific Inquiry* is significantly and positively related to the two environmental scales of *Teacher Support* and *Equity*.

Table 7 shows that the multiple correlation between an outcome measure the set of four environment scale is 0.08 for *Enjoyment of Science Lessons*, 0.21 for *Adoption of Science Attitudes*, and 0.23 for *Attitude to Scientific Inquiry*. The multiple correlation is statistically

significant ($p < 0.05$) only for *Attitude to Scientific Inquiry*. Regression coefficients are used to identify which of the four modified WIHIC scales account for unique variance in student *Attitude to Scientific Inquiry*. Table 7 shows that *Equity* is the only significant independent predictor of *Attitude to Scientific Inquiry*.

Table 7. Simple Correlation and Multiple Regression Analyses for Associations Between Student Attitudes and Dimensions of the Modified WIHIC

Scale	Attitude-Environment Association					
	Enjoyment of Science Lessons		Adoption of Science Attitudes		Attitude to Scientific Inquiry	
	r	*β*	*r*	*β*	*r*	*β*
Teacher Support	0.06	0.10	-0.06	0.07	0.15*	0.03
Involvement	-0.00	-0.02	-0.07	0.04	0.13	0.03
Cooperation	0.00	-0.02	-0.14	0.10	0.13	-0.01
Equity	0.00	0.04	0.19*	0.19	0.23**	0.20*
Multiple Correlation (*R*)		0.08		0.21		0.23*

*$p < 0.05$. **$p < 0.01$.
$N = 172$ students.
The sample size ($N = 5$) was too small to generate dependable statistics for class means.

To examine associations between kindergarten students' achievement and their perceptions of the learning environment, again simple correlation and multiple regression analysis were calculated (see Table 8). All simple correlations are positive (see Table 8) and four of the 12 correlations are statistically significant ($p < 0.05$). Each of the WIHIC scales (Teacher Support, Involvement, Cooperation, and Equity) has a statistically significant correlation with one of the achievement measures (Final Report, Final Diagnostic Test, or Kindergarten Readiness Test). Kindergarten Readiness scores are significantly correlated with Teacher Support and Equity, and Final Diagnostic Test scores are significantly related to Involvement and Cooperation.

Table 8. Simple Correlation and Multiple Regression Analyses for Associations Between Student Achievement and Dimensions of the Modified WIHIC

Scale	Achievement-Environment Association					
	Final Report		Final Diagnostic Test		Kindergarten Readiness Test	
	r	*β*	*r*	*β*	*r*	*β*
Teacher Support	0.37	0.15	0.20	-0.23	0.38*	0.36
Involvement	0.23	0.16	0.51**	0.41	0.35	0.12
Cooperation	0.13	0.00	0.40**	0.11	0.28	-0.19
Equity	0.29	0.19	0.33	0.29	0.39*	0.06
Multiple Correlation (*R*)		0.43		0.55		0.40

*$p < 0.05$. **$p < 0.01$.
$N = 28$ students.
The sample size ($N = 5$) was too small to generate dependable statistics for class means.

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Interviews

The first two interviews involved students. One student interview was conducted in Spanish and the second interview was conducted in English. The second set of interviews involved parents. One parent interview was conducted in Spanish and the second interview was conducted in English.

Some parents indicated that they were fairly aware of what was going on in their child's class because students discussed their science experiments at home, students needed help with their homework, parents encountered difficulty with the English language and required explanations on how to help their child with their homework, or students participated in donating materials from home to be used in their science class.

Detailed reporting of results from the interviews is beyond the scope of this paper. However the students and parents interviewed generally were satisfied with current science classes. However parents were dissatisfied with overcrowding in classrooms and felt that each kindergarten teacher should have a paraprofessional to help in the classroom.

CONCLUSION

This study is significant because it validated a revised version of an extensively-used questionnaire to economically evaluate very young kindergarten students' and their parents' perceptions of actual and preferred classroom learning environment. Additionally, because the study involved parents, it is likely to guide future studies that examine the important role that parents/families play in their child's education. Maccoby (1992) declared that parents play a central role in young children's socialization and learning. Thus, this study could help to support past research which suggest that parents/families play an invaluable part in their child's learning process.

The study involved a sample of 172 kindergarten students and 78 of their parents. We used a modified version of the What Is Happening In this Class? (WIHIC) questionnaire to assess students' and parents' perceptions of classroom environment. A modified version of the Test of Science-Related Attitudes (TOSRA) was used to assess students' attitudes toward science. A subsample of 10 students and their 10 parents were interviewed.

A selection of some of the study's key findings are summarized below:

Finding 1: The student actual form of the WIHIC displays satisfactory factorial validity and can differentiate between the perceptions of students in different classrooms.

Finding 2: The WIHIC demonstrates satisfactory internal consistency reliability for students and parents in both its actual and preferred forms.

Finding 3: Both students and parents prefer a more positive learning environment than is perceived to be actually present.

Finding 4: The magnitudes of differences between actual and preferred learning environment scores are larger for students than for parents.

Finding 5: Parents perceive a more favorable actual environment than students perceive, but students prefer a more favorable environment than parents prefer.

Finding 6: Teacher Support, Involvement, Cooperation, and Equity each show a significant simple correlation with one of three achievement measures.

Finding 7: Higher levels of Equity in the classroom were significantly correlated with Adoption of Science Attitudes.

Finding 8: Higher levels of Teacher Support and Equity in the classroom were significantly correlated with Attitude to Scientific Inquiry. Only Equity was significantly related to Attitude to Scientific Inquiry when the other WIHIC scales were mutually controlled.

Finding 9: The students and parents who participated in interviews (in English and Spanish versions) generally were satisfied with current science classes.

Finding 10: Parents were dissatisfied with student overcrowding in their child's kindergarten class and felt that each kindergarten teacher should have a paraprofessional in his/her classroom.

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